Data Quality Matters: Towards Trajectory Data Collection Under Local Differential Privacy

Hao ZHOU, Yexuan SHI, Yuxiang ZENG, Yongxin TONG

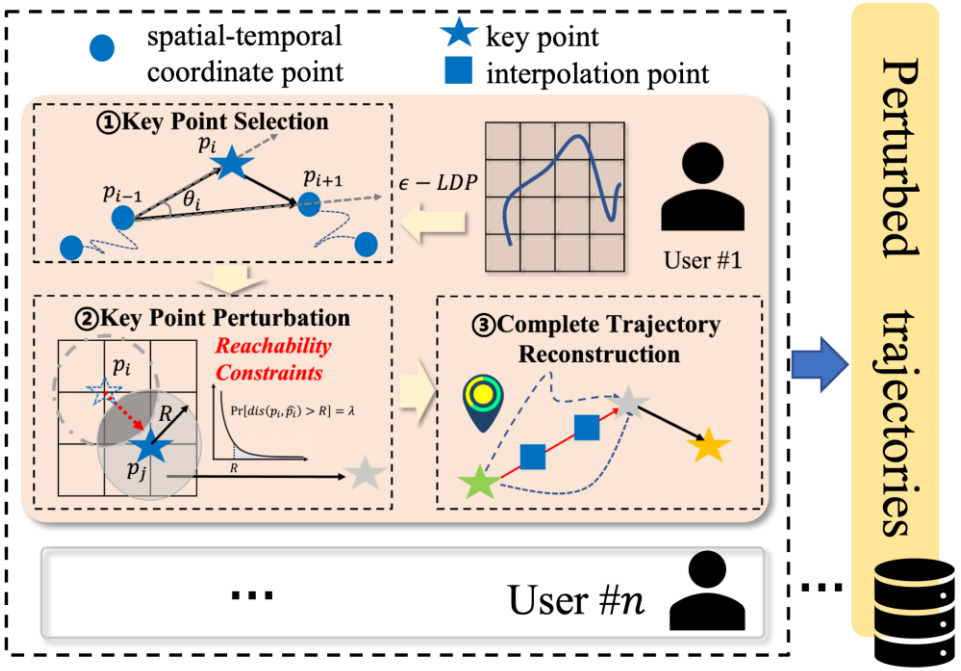
Frontiers of Computer Science, DOI: 10.1007/s11704-025-41435-9

Problems & Ideas

- Problems of trajectory data collection under Local Differential Privacy(LDP):

  The task is to collect user trajectory data while ensuring privacy through LDP and maintaining data utility. This involves adhering to the reachability constraint and minimizing dissimilarity with the original trajectory.

- Ideas: We propose a novel framework called DQ-LDP that captures key points in trajectories for perturbation to achieve high-quality trajectory data collection under LDP.



Main Contributions

- Contributions:
  - We propose a novel key point selection method that captures the backbone of a trajectory, allocating privacy budget only to these key points to optimize the privacy budget allocation.
  - We utilize a distance-aware exponential mechanism to perturb each key point while adhering to the reachability constraint to restrict the perturbation region.
  - Extensive experiments are conducted on several real-world datasets, with DQ-LDP being compared against 4 state-of-the-art methods. The results demonstrate that higher-quality trajectories are consistently generated by DQ-LDP than these baselines under the same privacy requirement.